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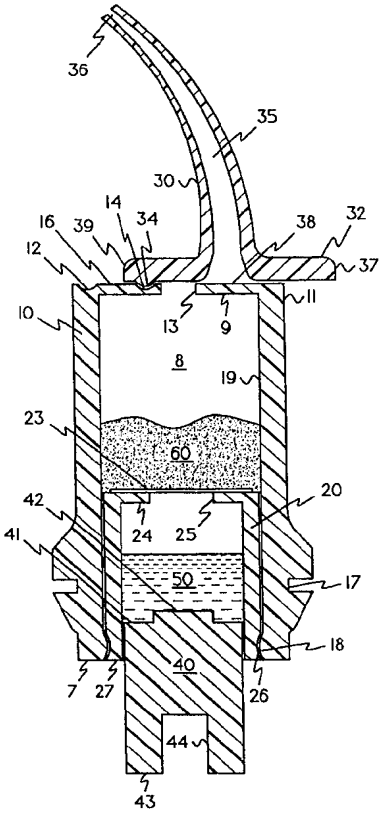
(54) Title: MIXING/DISPENSING CAPSULE

(57) Abstract

Mixing and application [dispensing] capsule for dental materials comprised of a container (10), a tubular piston (20) provided with a stamp (40) as a liquid container, whereby tubular piston (20) is held via a recess (26) during activation in an appropriately configured projection (18) of container (10) opposite the hand force displacing stamp (40), and a slider (32), which is joined with a discharge cannula (30), is hereby characterized in that container (10) has a guide groove (15) above passage borehole (13), in which [groove] slider (32) that can be moved by hand force is held, which tightly seals the capsule in the rest state, and, after the components have been mixed, releases the dental material in the conducting position via the connected discharge cannula (30).



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MIXING/DISPENSING CAPSULE

Technical Field

The invention concerns a mixing and application or dispensing capsule for dental materials.

Background of the Invention

In a known system (DE 3,920,537), a tubular piston is supported against the container with a tear-off ring. In order to activate the capsule, i.e., to empty the content of the liquid pouch into the mixing space, the tear-off ring is removed with a gripper tool.

It is a disadvantage, this type of system, that additional working steps, such as inserting the capsule into the gripper tool prior to activating and then removing it after activating are required for activating the capsule. This is particularly a problem in the stage after the activation, since there should be no delay in the transfer of the mixing capsule into the conventional vibrating mixer. With a corresponding delay, there is the danger that the components introduced together will harden, due to the very short setting time of the dental material, without having been mixed together homogeneously, and the dental material will suffer from intolerable losses in quality.

In addition, it is a disadvantage that the piston is not held captive, since support of the piston is movable only in the direction of the discharge opening. It is also known (DE 4,315,920) to use a blocking component that can be plugged in, which engages in a special recess of the tubular piston. In this way, the tubular piston is held in its position during activation and mixing in a vibrating mixer.

It is a disadvantage in this solution that an additional part is required. This increases production costs and expenditure for mounting the filled mixing capsule.

Further, it has turned out that the blocking component is not held captive in the recess. This can have as a result the fact that the blocking component slips out during transport to the user and in the most favorable case is subsequently inserted by the user. In the most unfavorable case, the user attempts to activate the mixing capsule without he blocking component. In addition to the relative movement between stamp and tubular piston, an undesired relative motion is produced between the tubular piston, and the mixing chamber. There is the danger here that the volume of the mixing chamber is reduced such that a homogeneous mixing of the components of the dental material is no longer possible.

Another disadvantage of this solution is that first, the ratio of the diameter of the stamping rod to the stamping plate is so small, and secondly, the ratio of the length of the stamping rod to the height of the stamping rod is so large, that the stamping rod becomes kinked with an oblique placement of the capsule during the activating process. Occasionally, fluid is thus pressed through the radial gap formed between the stamping rod and the throughput opening, which again can lead to undesired impurities.

Common to both named solutions DE 3,920,537 and DE 4,315,920 is the seal of the squirting channel by a sealing pin. This is a disadvantage in that for a secure and comfortable introduction, the squirting channel should be slightly conical over its length and of funnel shape in the inlet region, but dead spaces are formed relative to the cylindrical pin and walls of the squirting channel, in which the powdery components attach during storage and transport to the user and then do not participate in the mixing process. It has been observed that this unmixed material adheres at the front end of the paste cord during discharge, so that if it is not removed, it is the first to reach into the tooth cavity and does not harden there in a regular manner.

Disclosure of the Invention

It is thus the object of the invention to create a mixing and dispensing capsule, which can be activated by hand in the simplest way and is reliable in operation in practice, and on the other hand produces homogeneous mixtures and can be produced, mounted, and filled in a cost-favorable manner.

This object is resolved according to the invention by claim 1. Advantageous further embodiments are found in the subclaims, and in the present disclosure.

According to the invention a container has in one end lying opposite a throughput borehole a correspondingly configured projection, which engages in a correspondingly configured recess of the tubular piston in the resting state, and secondly by the fact the container has, above the throughput borehole, a guide groove, in which a slider joined with a discharge cannula is guided in a sliding motion and can be stopped both in the sealing and conducting positions. Unexpectedly, a secure support of the tubular piston during the emptying of the same (activation process) can be assured with the catch or snap connection, which comprises an appropriately configured radial projection of the inner wall of the container at the end lying opposite the throughput borehole in the position of rest of the mixing and dispensing capsule, and of an appropriately configured radial recess of the piston. Neither a blocking clip nor a ring to be pulled off is necessary in order to compensate for the forces that arise.

Since the catch or snap closure will hold the tubular piston in its position of rest only during the activation and mixing of the mixing capsule, according to a particular feature of the invention, the tubular piston can be displaced without friction up to a limited feed or advance. This means that the blocking function, which is produced by the interaction between the projection of the inside wall of the container and the recess of the outer wall of the tubular piston is joined at a limited extent of

advance of the stamp, which is sufficient for emptying the tubular piston, while it terminates after this. The friction-free advance after mixing can only be guaranteed if the projection lies on the inner wall of the container and the recess lies on the outer wall of the tubular piston. In a particularly advantageous embodiment of the invention, the radial projection of the container, which is shaped as a convexly arched inner surface, engages in the radial recess of the tubular piston, which is shaped as a concavely arched outer surface.

Another advantage results due to the fact that the stamp is shaped like a cylinder with a uniform outer diameter, which is adapted to the diameter of the tubular piston. The diameter is reduced only in the short region of the stamping plate. In this way, the guide of the stamp in the piston is stable such that even with an oblique placement of the piston for activating the mixing and dispensing capsule, no radial gap is formed between the inner wall of the tubular piston and the outer wall of the stamp, and thus a leaking out of liquid is reliably avoided.

An erroneous pressing of the stamp is avoided in that the friction between the stamp and the tubular piston is selected sufficiently high. This can be accomplished, on the one hand, by an appropriate adaptation and material selection for the stamp and the tubular piston and/or, on the other hand, by an appropriate catch or snap connection as described above between the stamp and the tubular piston. In addition, this can be accomplished by an elastic O-ring which may be located in a recess in the stamp wall. Another advantage of the elastic O-ring is the increased sealing between the inner wall of the tubular piston and the outer wall of the stamp.

It is particularly favorable that the liquid container, which is formed by the tubular piston, the stamp as the bottom and the foil as the cover, can be mounted and filled in a simple way.

Since the mixing and dispensing capsule will hold different dental materials, it is understood that the inside space of the tubular piston that is not taken up by the stamp, as well as the inside space of the container not taken up by the tubular piston, will have sufficient remaining space in order to take up the quantities of the mixing components that occur, whereby the residual volume in the container must be designed for liquid components and for the mixing process, in addition to holding the powder components.

According to another preferred configuration, the container has, above the throughput borehole, a guide groove that becomes wider toward the inside, in which a conical slider, which is joined with a discharge cannula without a transition, is held in a sliding manner. An accidental displacement of the slider will be avoided by the cooperation of an appropriately configured buckling-out piece on the underside of the slider and two appropriately configured indentations in the guide groove of the container. The resulting friction between the slider and the guide groove is selected in such a way that the slider can be actuated by hand.

In the sealing position, the slider seals the mixing and dispensing capsule in an air-tight manner, by catching the buckling-out piece of the slider in the indentation of the guide groove lying closest to the discharge opening. After mixing, the slider is displaced in the direction of the indentation lying further away to the throughput borehole and after a specific amount of displacement catches with its buckling-out piece on the underside. The specific amount of displacement results from the distance of the two indentations in the guide groove. The distance and the position of the two indentations in the guide groove are selected such that the mixing and dispensing capsule is closed in the sealing position in an airtight manner by the slider, and after mixing, the discharge opening is brought to the throughput borehole in the cover, so that the channel of the discharge cannula is maximally accessible. It is

understood that the slider has a length such that in the sealing position, one end of the slider projects over the edge of the mixing and dispensing capsule by an amount corresponding to the amount of displacement between the indentations of the guide groove. Surprisingly, by the position of the actuating end of the slider and by the thus-associated position of the discharge cannula, the state of the mixing and dispensing capsule can be clearly recognized and this excludes error in the operation. In addition, with the system of the buckling-out piece on the underside of the slider and the indentations in the bottom of the guide groove, it is achieved that the slider can be stopped only in positions that are important for the function of the mixing and dispensing capsule.

The invention will be explained below in more detail with reference to the drawing, which illustrates schematically the advantageous examples of embodiment.

Brief Description of the Drawings

Fig. 1 shows a longitudinal section of the mixing and dispensing capsule of the invention in a first form of embodiment in the finished, mounted state, prior to activation.

Fig. 2 shows a representation corresponding to Fig. 1 of a first form of embodiment after activation.

Fig. 3 shows a representation corresponding to Fig. 1 of a first form of embodiment after emptying.

Fig. 4 shows a longitudinal section of the slider and the guide groove in a single representation.

Fig. 5 shows a section along line A-A of Fig. 4.

Fig. 6 shows an alternative embodiment of the capsule of Fig. 1.

Preferred Embodiments for Carrying Out the Invention

A mixing and dispensing capsule according to the invention, has a cylindrical container 10, a liquid container 20 shaped as a tubular piston, a stamp 40, and a slider 32 joined with a discharge cannula 30.

According to Fig. 1, container 10 forms, within cylindrical walls 19, mixing chamber 8, which is bounded at the top by a front wall 9 with a throughput borehole 13 and on the bottom by foil 23 of tubular piston 20. Above throughput borehole 13, the outer walls of container 10 have a guide groove 15 (Fig. 4) becoming wider toward the inside, which takes up slider 32, which is joined with discharge cannula 30. In order to sufficiently compensate for the forces that act on discharge cannula 30 when the finished mixed dental material is pressed out, guide groove 15, as can be better seen from Fig. 4, is shaped like a wedge. It is understood that the guide groove 15 can also be configured as broadening inwardly in stepped form. According to the invention, slider 32 is adapted in its shape to correspond to guide groove 15. Slider 32 has on the underside of the sealing end, a semi-spherical buckling-out piece 34, which can catch in semi-spherical indentations 12 and 14 sunk in bottom 16 of guide groove 15.

The length of slider 32 is selected such that the actuation end 37 in the sealing position of slider 32 projects over edge 11 by an amount corresponding to the amount of displacement between indentations 12 and 14. It is preferred to establish the friction between slider 32 and guide groove 15 by an appropriate adaptation, so that slider 32 can be actuated by hand by actuation end 37; in the sealing position mixing chamber 8 is sealed in a substantially airtight manner by sealing end 39, and in the conducting position, the flow of mixed dental material flows out only through discharge opening 38. Slider 32 is joined with discharge cannula 30 above discharge opening 38. It is preferred that slider 32 and discharge cannula 30 are combined into

one part. Channel 35 between discharge opening 32 and mouth opening 36 is constricted in a funnel form in the region of the inner wall of slider 32 and runs slightly conical in the region of the inner wall of discharge cannula 30. In this way, a particularly favorable flow profile results, which facilitates the discharge of highly viscous dental materials, such as, for example, glass ionomer filling cements.

It is of particular advantage for the user that discharge cannula 30 is bent in such a way that a favorable working range of 30-50° relative to the longitudinal axis of the mixing and dispensing capsule results thereby.

Mixing chamber 8 holds the powdery components of the dental material in the prepared state according to Fig. 1. The hollow space that is formed by mixing chamber 8, is thus dimensioned such that even when the maximal filling volume is provided, there always remains enough hollow space unfilled, so that a good intermixing is later possible.

Behind mixing chamber 8, the cylindrical inner wall 19 of container 10 forms a well-sealing guide for tubular piston 20, which serves on the one hand as a liquid container and on the other hand as an uptake for stamp 40. In the lower part, container 10 has an outer projection in the form of an annular groove 17, which produces the connection with a discharge gripper tool (not shown) acting on stamping surface 43. Inner wall 19 of container 10 ends in a radial, convexly arched inner projection 18, which has a smaller diameter than the inside wall 19 of the container. Projection 18 is limited at the bottom by the radial foot surface 7.

Tubular piston 20 is positioned inside container 10. The inside space of tubular piston 20 is bounded by the cylindrical inner wall of the latter, by the inner surface 24, by foil 23, and by the front surface of stamp 41. This inside space holds the liquid components of the dental material. Mixing opening 25 has a smaller diameter than the diameter of the inner wall of the tubular piston. Foil 23, which

serves for sealing the mixing opening 25 in the state of rest of the mixing and dispensing capsule, is glued or is bonded onto the back side of inside surface 24, whereby the diameter of the circular foil 23 is larger than the diameter of mixing opening 25 and smaller than the diameter of the inner wall of container 10. Thus a radial bonding edge reaching over the diameter of the outer wall of the tubular piston, which negatively influences the mounting and sliding of tubular piston 20 in container 10, can be reliably avoided.

A foil 23, which has a smaller tearing resistance than the strength of the adhesive or bonding joint between foil 23 and inner surface 24 is preferred, so that during activation according to Fig. 2, foil 23 is reliably burst open and liquid 50 flows into mixing chamber 8.

The outer wall of tubular piston 20 ends in a radial, concavely arched recess 26, which has a smaller diameter than the outer wall of tubular piston 20. Recess 26 is bounded at the bottom by radial foot surface 27 and is substantially flush with foot surface 7. It is assured in this way that tubular piston 20 is taken up completely in container 10 and when activated by hand, there is no displacement of tubular piston 20 relative to container 10, if stamp 40 is completely pushed into tubular piston 20.

In the rest position of the mixing and dispensing capsule, the catch or snap connection results by the catching of projection 18 of container 10 in recess 26 of tubular piston 20. Projection 18 is configured to recess 26 such that, tubular piston 20 is held sufficiently rigidly in the desired position of rest during storage and transport to the user as well as according to Fig. 2 during the activation process, and, on the other hand, according to Fig. 3, the friction, which arises between tubular piston 20 and container 10 with a further advance of stamp 40, is not too great, so that the discharge of the mixed dental material is reliably assured with a known discharge gripping tool.

Stamp 40, which has a front surface 41 with a projection 42 is found inside tubular piston 20. The friction between the inner wall of tubular piston 20 and the outer wall of stamp 40 is selected in such a way that stamp 40, not without exercising hand force, changes its relative position to tubular piston 20, which is adjusted in the tension of the assembly. It is understood that the friction can also be provided by a catch or snap connection, which exists between a radial, convexly arched projection of the inner wall of tubular piston 20 and a radial, concavely arched recess of the outer wall of stamp 40. Another provision for friction and improved sealing is the use of an elastic O-ring 45 (Fig. 6) which is located in a preferably concavely arched recess 46 of the outer wall of stamp 40.

The length of stamp 40 is preferably adapted to the length of tubular piston 20, so that stamp 40 can be completely taken up in tubular piston 20. In addition, front surface 41 with projection 42 is adapted to inner surface 24 with mixing opening 25, as can be seen from Fig. 2, so that projection 42 fills up mixing opening 25 when stamp 40 is completely pressed in. In this way, the liquid component is completely expelled from the tubular piston. For purposes of reducing material, stamp 40 is provided with a borehole 44 (Fig. 1).

The essential functional states of the mixing and dispensing capsule are shown in Figs. 1, 2 and 3.

In Fig. 1, the mixing and dispensing capsule is shown in the state of rest. For activation, stamp 40 is pressed by hand against a rigid base, e.g., a working surface. In this way, stamp 40 is displaced in tubular piston 20 and exercises a pressure on liquid component 50 and expels the residual air that is present, which in turn presses on foil 23. After a specific advance, foil 23 bursts and the liquid component 50 is injected into mixing chamber 8. The end of the activation process is clearly indicated, as is better seen from Fig. 2, if stamp foot surface 43 ends flush with foot

surfaces 7. It is understood that projection 42 is also flush with the upper end of mixing opening 25, and liquid component 50 is completely injected into the mixing chamber. During the activation process, no relative motion occurs between tubular piston 20 and container 10.

In this state, the mixing and dispensing capsule is utilized in a known vibrating mixing device, in order to produce a homogeneous mixing of components 50 and 60 of dental material introduced together into mixing chamber 8. After this, the capsule is removed and mixing chamber 8 is opened by displacing slider 32 into the conducting position. As can be seen from Fig. 5, slider 32 is moved such as by finger pressure, onto the actuating end 37 in the direction of the arrow. Thus buckling-out piece 34 at the underside of slider 32 is popped out of indentation 14. In the conducting position of the slider, buckling-out piece 34 catches notably in indentation 12, discharge opening 38 is covered by the throughput borehole, and the actuation end 37 as well as sealing end 39 are flush with the edge of the cylindrical outer wall of container 10.

In this state, the mixing and dispensing capsule can be emptied. This is done by inserting the mixing and dispensing capsule into a known discharge gripper tool. The finished mixture is pressed out through discharge cannula 30 by advance of stamp 40, whereby the empty state is shown in Fig. 3. Tubular piston 20 is then completely pushed into mixing chamber 8 with the pushed-in stamp 40.

Patent Claims:

1. Mixing and application capsule for dental materials comprising a container, a tubular piston provided with a stamp as a liquid container, whereby said tubular piston is held via a recess during activation in an appropriately configured projection of said container opposite said stamp, and a slider which is joined with a discharge cannula, wherein said container has a guide groove above a passage borehole in which said slider can be moved by hand force and is held, which tightly seals the capsule in the rest state, and, after the components have been mixed, releases the dental material in the conducting position via said cannula.

2. Mixing and dispensing capsule according to claim 1, wherein said projection is arched convexly and runs radially.

3. Mixing and dispensing capsule according to claim 1, wherein said recess 26 is arched concavely and runs radially.

4. Mixing and dispensing capsule according to claim 1, wherein said projection catches in said recess.

5. Mixing and dispensing capsule according claim 1, wherein said cannula is bent and over an operating range of from about 30 to about 50° relative to the longitudinal axis of the mixing and dispensing capsule.

6. Mixing and dispensing capsule according as in claim 1, further comprising a channel in said cannula which is first narrowed in funnel form

proceeding from a discharge opening in one end thereof, and then runs conically over its length.

7. Mixing and dispensing capsule according to claim 6, wherein said discharge opening is substantially identical in diameter with said borehole.

8. Mixing and dispensing capsule according to claim 1, wherein said slider 32 is held in a sliding manner and is joined with said cannula.

9. Mixing and dispensing capsule according to claim 8, wherein said container further comprises above said borehole, a guide groove expanding toward the inside for taking up said slider.

10. Mixing and dispensing capsule according to claim 9, wherein said guide groove is configured in wedge or step shape.

11. Mixing and dispensing capsule according to claim 9, wherein said slider is adapted in shape to correspond to said guide groove, and has a semi-spherical buckling-out piece on the underside of a sealing end thereof.

12. Mixing and dispensing capsule according to claim 11, further comprising two semi-spherical indentations sunk in the bottom of said guide groove.

13. Mixing and dispensing capsule according to claim 12, wherein said buckling-out piece is caught in said indentation, whereby said borehole is sealed in an airtight manner by said slider.

14. Mixing and dispensing capsule according to claim 13, wherein said buckling-out piece is engaged in said indentation if the mixed dental compound will be discharged, and whereby said discharge opening is covered with said borehole.

15. Mixing and dispensing capsule according to claim 14, wherein said slider has a length such that an actuation end thereof projects over an edge by an amount corresponding to the amount of displacement between said indentations in the sealing position of said slider, and said slider can be actuated by hand by depressing said actuation end.

16. Mixing and dispensing capsule according to claim 1, wherein said stamp is substantially sunk into said tubular piston, and the length of said stamp substantially corresponds to the length of said tubular piston.

17. Mixing and dispensing capsule according to claim 16, wherein in the mounted state, said stamp is held in said tubular piston by a suitable adaptation, which is obtained by suitable selection of dimensions and materials.

18. Mixing and dispensing capsule according to claim 16, wherein in the mounted state, said stamp is held in said tubular piston by a catch or snap connection which is comprised of the catching of a radial, convexly arched projection in a radial, concavely arched recess.

19. Mixing and dispensing capsule according to claim 1, wherein the friction of said tubular piston against said container is greater than the friction of said stamp against said tubular piston.

20. Mixing and dispensing capsule according to claim 1, wherein said stamp is held in said tubular piston by an elastic O-ring located in a radial, concavely arched recess.

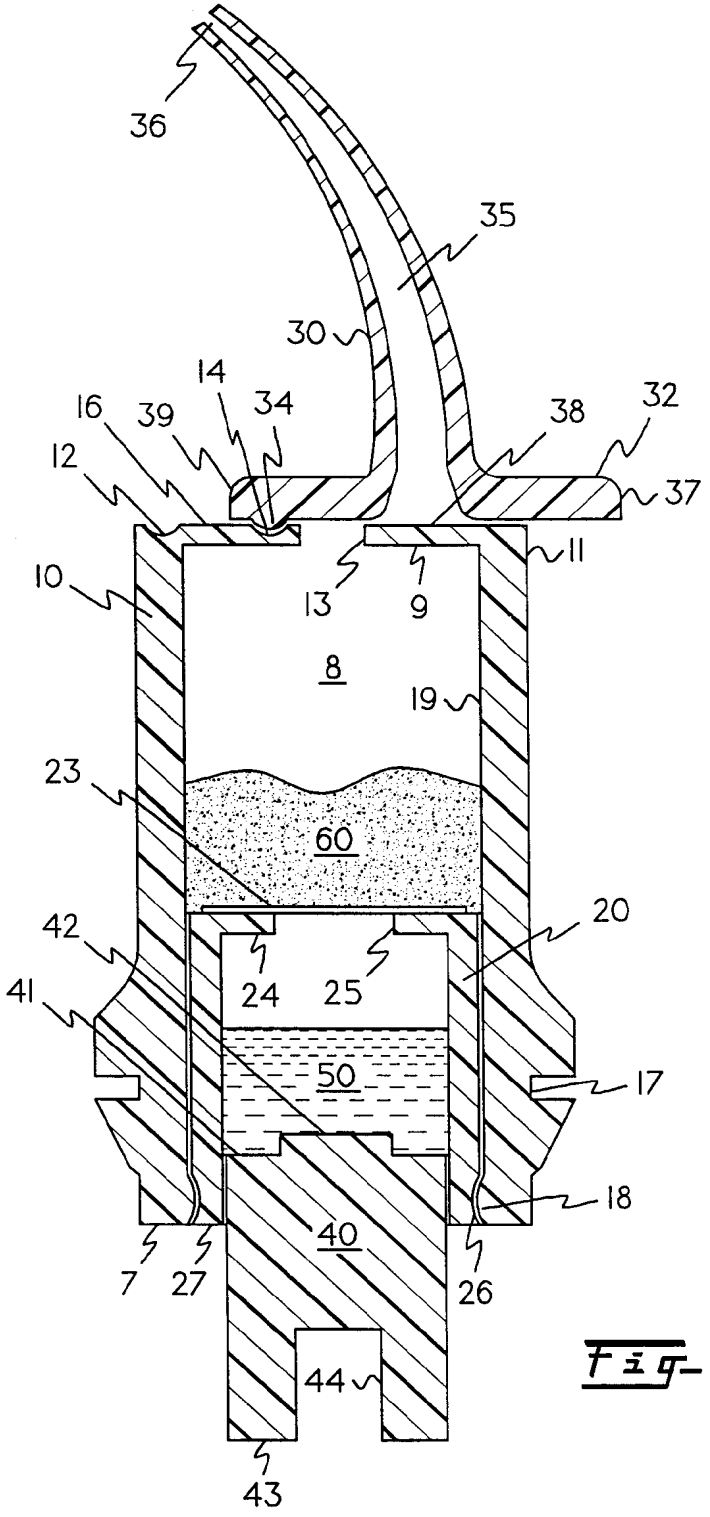
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Fig. 1

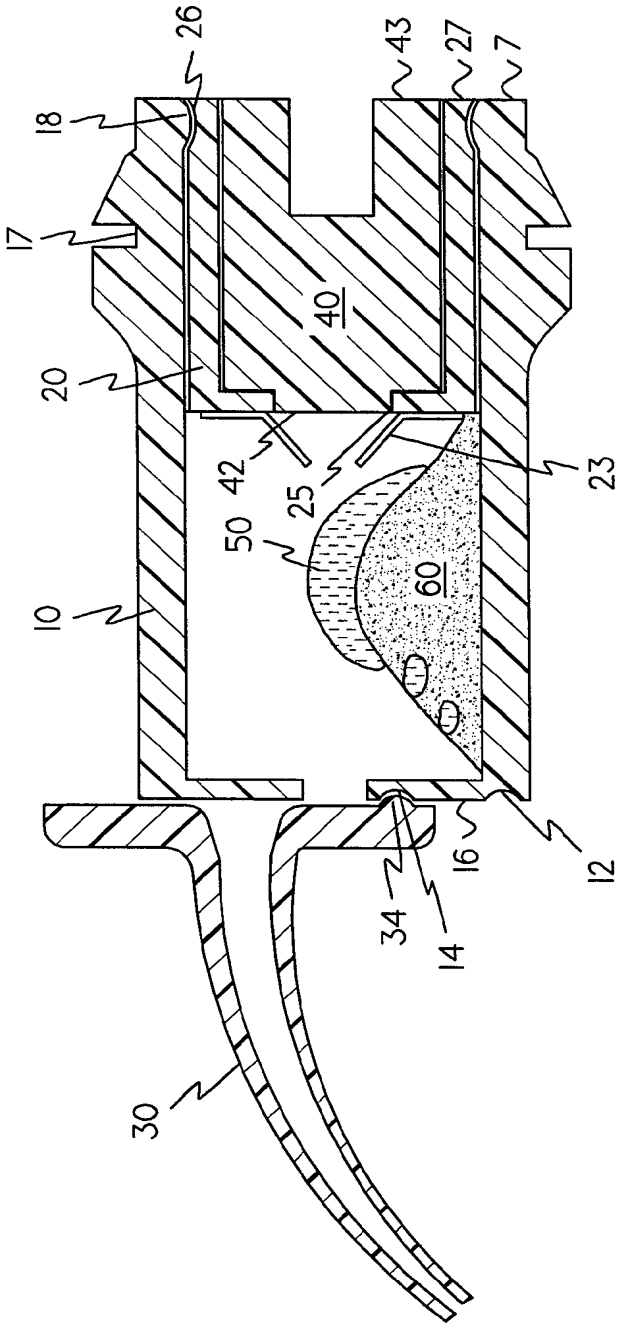

Fig. 2

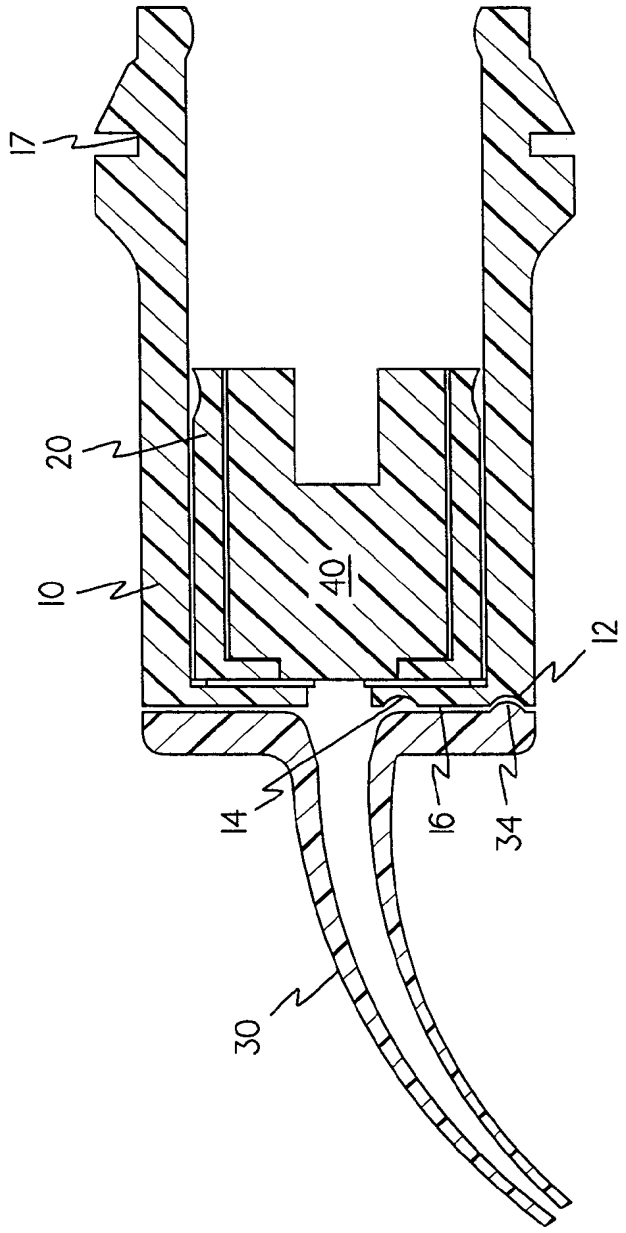

Fig-3

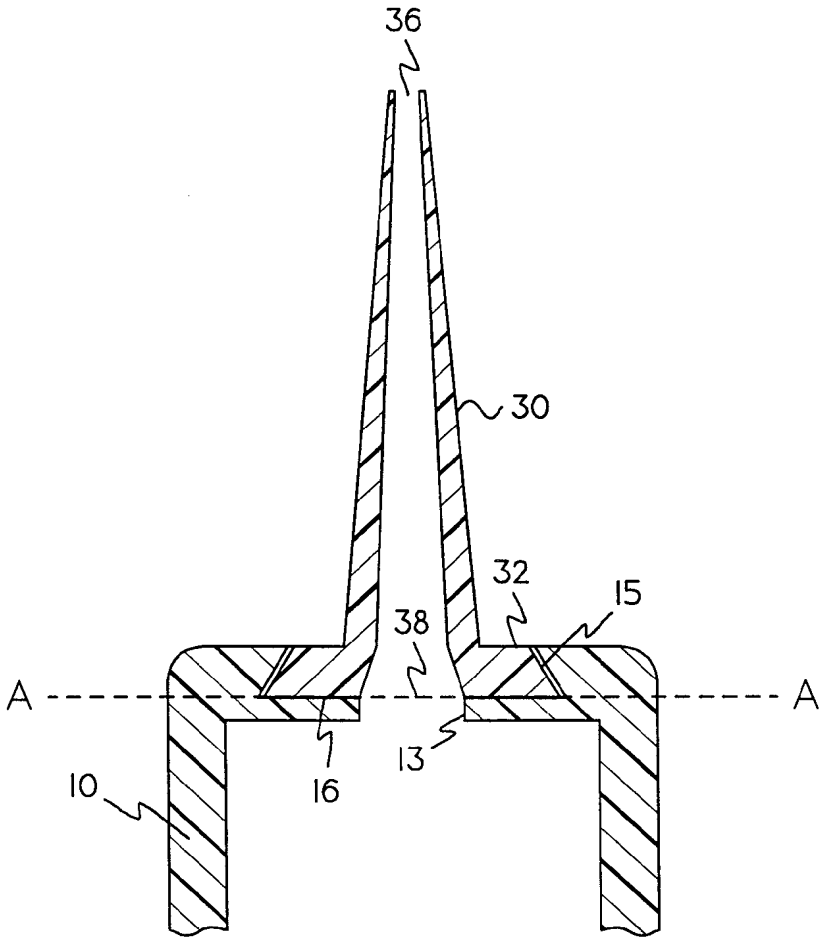

Fig. 4

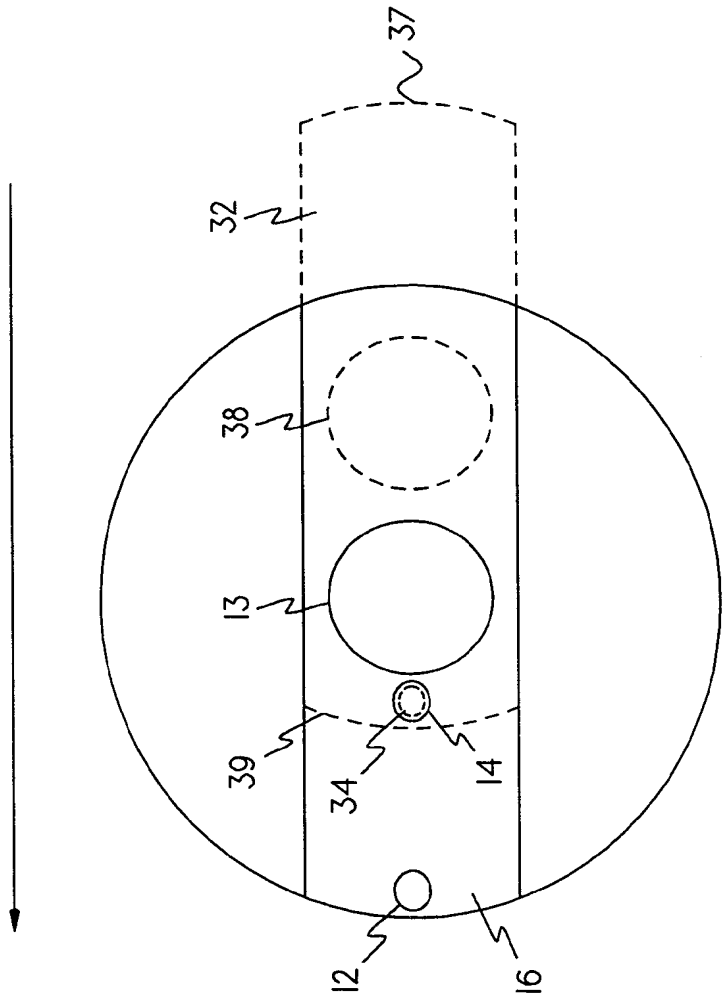

Fig. 5

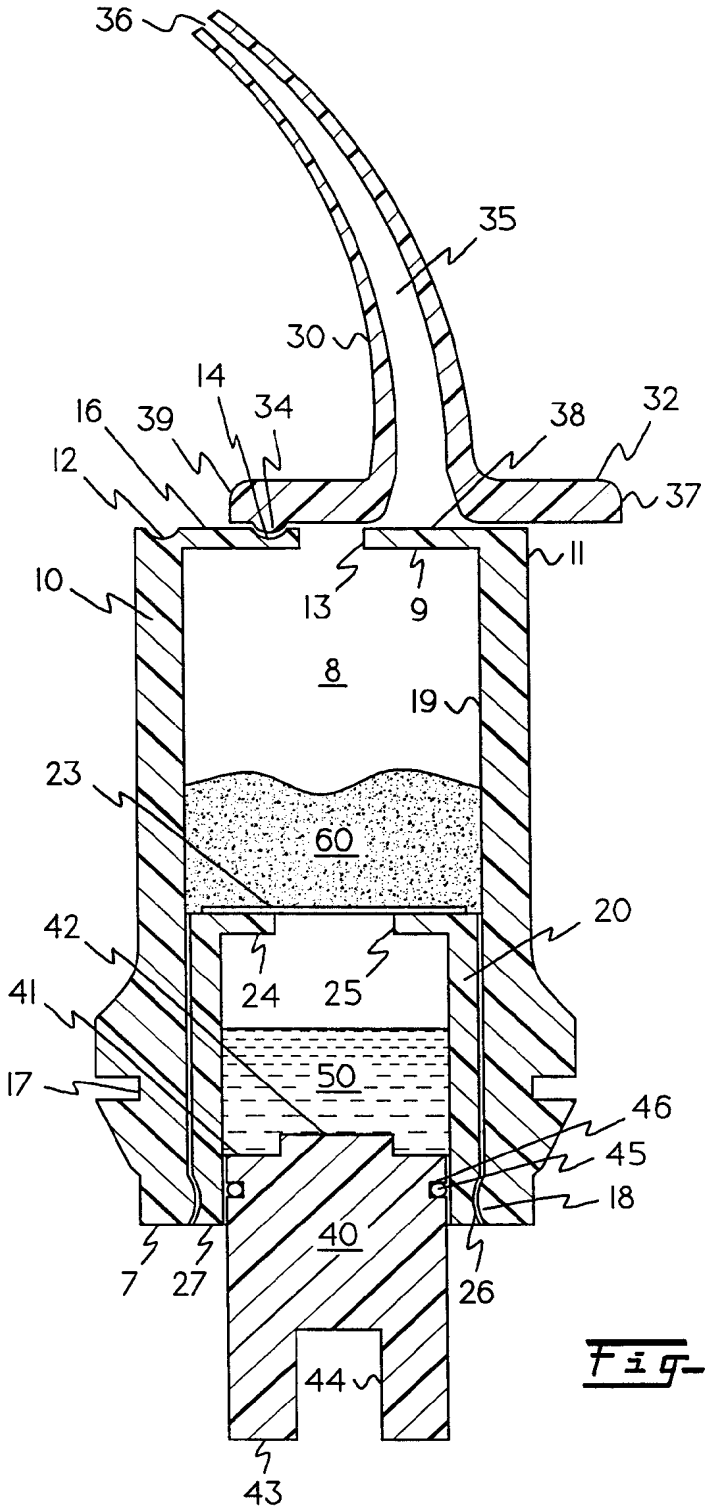
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Fig. 6

INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/US 99/23832

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61C5/06 B65D81/32 B05C17/005

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61C B65D B05C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 739 947 A (BAUMANN E ET AL) 19 June 1973 (1973-06-19) column 1, line 46-53 column 5, line 1-4 column 6, line 12-43 figures 2,5	1-4, 16-20
A	US 5 026 283 A (OSANAI SATOSHI ET AL) 25 June 1991 (1991-06-25) column 3, line 38-43 figure 1	1,5-7
A	US 2 969 167 A (S. M. LIBIT) 24 January 1961 (1961-01-24) column 2, line 17-38 figures	1,8-15

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Date of the actual completion of the international search	Date of mailing of the international search report
7 February 2000	16/02/2000

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